IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re the application of:
HUI-JUNG WU, ET AL.

Docket: 30-4731 (4780) DIV-1

Serial Number: 09/841,453

Group Art Unit: 2829

Filed: April 24, 2001

Examiner: Asok K. Sarkar

For: USE OF MULTIFUNCTIONAL SI-BASED OLIGOMER/POLYMER FOR THE SURFACE MODIFICATION OF NANOPOROUS SILICA FILMS

**REPLY BRIEF FOR APPELLANT**



Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Sir:

This Reply Brief is in response to the new points of argument raised by the examiner in his Examiner's Answer mailed March 29, 2004. This Reply Brief is hereby filed in triplicate.

The issues in this case are substantially the same as those in which the examiner's rejections were reversed on appeal in the parent application to this case, namely, serial number 09/488,075 (Appeal No. 2003-1366). The parent case presented process claims and this application claims the product prepared by that process.

The instant claims are directed to a *nanoporous* silica film produced by a process comprising the steps of reacting a suitable silica film with a composition comprising a surface modification agent, wherein said silica film is present on a substrate and wherein said reaction is conducted under conditions and for a period of time sufficient for said surface modification agent to form a hydrophobic coating on said film and said surface

modification agent comprises at least one type *of oligomer or polymer reactive with silanol groups* on said silica film.

In this application the examiner has applied Jin, et al (EP 08 49796) to show the feature of a nanoporous silica film which is hydrophobized by a monomer. In the parent application the examiner used different art, namely Gnade, et al (U.S. 5,470,802) and Masakara, et al (U.S. 6,037,277) to show this same feature. These latter references were then combined with Kotelnikov (RU 2089499) for showing an oligomeric or polymeric surface modification agent. In both cases the examiner ignored the fact that Kotelnikov is completely non-analogous art. The present invention pertains to *nanoporous* silica film which is employed in producing microelectronic devices, while Kotelnikov relates to the oil and gas industry.

This was the basis for the Board's overruling of the rejections in parent case serial number 09/488,075 (Appeal No. 2003-1366). For the convenience of the Board, their decision on this issue is repeated below:

OPINION

> Upon careful review of the respective positions advanced by appellants and the examiner with respect to the rejections that are before us for review, we find ourselves in agreement with appellants' viewpoint in that the examiner has failed to carry the burden of establishing a prima facie case of obviousness. See In re Oetiker, 977 F.2d 1443, 1445, 24 USPQ2d 1443, 1444 (Fed. Cir. 1992) ; In re Piasecki, 745 F.2d 1468, 1471-1472, 223 USPQ 785, 787-788 (Fed. Cir. 1984). Accordingly, we will not sustain the examiner's rejections.
>
> Masakara and Gnade are generally directed to the manufacture of highly porous dielectric films on semiconductor substrates. Both Masakara and Gnade disclose the optional use of surface modifiers, such as trimethylchlorosilane (TMCS), to help impart desirable properties, such as hydrophobicity, to the film.

The examiner has determined that "Masakara and Gnade fail to disclose that the surface modification agent is an oligomer or polymer reactive with silinols (sic) on the silica film" (answer, page 3), a feature required by all of appellants' claims. In order to make up for that acknowledged deficiency in the teachings of Masakara or Gnade relative to the here claimed subject matter, the examiner turns to Kotelnikov. In this regard, the examiner (answer, page 3) asserts that:

> Kotelnikov et al. disclose a method of producing hydrophobic silica coatings by chemical modification reactions with oligomer or polymer silicon-containing compounds.
>
> Therefore, given the substantial teachings of Masakara et al. and Gnade et al. in view of Kotelnikov et al., it would have been obvious to one with ordinary skill in the art at the time of the invention to use a surface modification agent, which is an oligomer or polymer reactive with silinols *(sic)* on the silica film.

In the supplemental answer, a further summary of what the examiner regards Kotelnikov to teach regarding the use of an oligomeric or polymeric modification agent is provided. However, the examiner has not identified a particularized suggestion, reason or motivation to combine the applied references.

As pointed cut by appellants in the briefs (see, e.g., page 8, first two paragraphs of the brief), the examiner has not identified a reasonable incentive for the proposed modification of either of the primary references based on the applied references' teachings. In this regard, the primary references are concerned with dielectrics including silanol containing silica coatings for semiconductor substrates and the constellation of properties associated therewith and Kotelnikov (pages 2 and 3) is concerned with hydrophobic dispersed substances useful in the oil and gas industry for changing the oil and water permeability of strata. While Kotelnikov is directed to improving hydrophobicity properties of dispersed silica substances for use in the oil and gas industry via surface modification using oligomer or polymer silicon—containing compounds (for example, polymethylsilazanes) as a possible fourth component in their method (Kotelnikov, page 8), the examiner has not established that the surface modification oligomer or polymer silicon—containing agents disclosed by Kotelnikov would be useful in the disparate semiconductor manufacturing methods of the primary references while not adversely affecting the properties of the semiconductors. The examiner's effort falls short in failing

> to establish a particularized suggestion for the proposed modification of the specific primary references ' semiconductor fabrication methods in a manner that would have led one of ordinary skill in the art to arrive at the claimed invention with a reasonable expectation of success in so doing. See In re Rouffet, 149 F.3d 1350, 1359, 47 USPQ2d 1453, 1459 (Fed. Cir. 1998) . The examiner has not shown how the other references applied by the examiner in rejecting claims 8, 11—14 and 17 remedy the above-noted shortcomings. It follows that we will not sustain either of the examiner's rejections.

The issues are substantially the same in the rejections in the instant case.

Jin et al. discloses dielectric materials comprising a porous organic silica dielectric on a surface for semiconductor and microelectronic device manufacture. Jin et al's pore surfaces may be rendered hydrophobic by rinsing with a *monomeric* material such as hexamethyldisilazane (HMDS). However, as the examiner admits, Jin *fails* to teach a surface modification agent which is an *oligomer or polymer*.

The Examiner attempts to fill these deficiencies by citing Grainger to teach the use of an oligomer/polymer to impart hydrophobicity on a surface. Grainger relates to polymers which form ultrathin polymeric films which are bonded onto a substrate surface, to thereby impart various useful properties onto the surface. However Grainger fails to teach the formation of a *nanoporous silica* film on a substrate, wherein the pore surfaces of the film are rendered hydrophobic, as required by the present invention. Rather, Grainger teaches the formation of film on a *solid substrate surface*, followed by the imparting of hydrophobicity to the *substrate*. Furthermore, nowhere does Grainger teach the formation of a *porous* film which is hydrophobized, let alone a *nanoporous silica* film. Grainger's long polymeric molecules formed by a Langmuir-Blodgett technique, for imparting hydrophobicity to the substrate *would not fit* into a pore structure of a nanoporous film, and thus would not be useful with the present invention.

Applicants call upon the Board to follow their decision in the parent case to this application where Kotelnikov, was not combinable with the nanoporous silica reference because it is

non-analogous art and only pertains to the oil and gas industry, i.e. for the production of a material for use in oil and gas wells, for changing the oil- and water- permeability of strata formed in such wells. The material formed according to this reference is applied onto elements of oil-gas complexes to increase their resistance to aggressive media, corrosion, icing, and biological growth. This reference clearly does not suggest any applicability to a nanoporous silica film on a substrate, having silanols on said silica film, as required by the present invention.

With specific regard to claim 17, the examiner has combined Jin, Grainger, and Kotelnikov and additionally applied Burns (U.S. patent 5,750,610). The arguments for Jin, Grainger, an Kotelnikov are repeated from above and apply equally herein. Burns fails to teach a film on a substrate and importantly fails to teach or suggest an *oligomer or polymer* which is reactive with silanol groups on any such silica film. The examiner specifically points to column 7, lines 36-40 of Burns, et al for the proposition that Burns, et al employ oligomers. However, these are not oligomers or polymers. The are monomers. In addition, Burns, et al does not teach a nanoporous silica film on a substrate, wherein the surface the silica film is to be hydrophobized. Rather, Burns et al. form a reaction product of a silica with an organosilane and a strong acid in a flask (see examples), to provide a hydrophobized reaction product. Such does not pertain to a coating on a substrate at all.

Claims 2-29 and 31-34 stand rejected for obviousness-type double patenting over claims 1-19 of U.S. patent 6,318,124 (Rutherford et al.) in view of Grainger (U.S. patent 5,686,549) and in further view of Kotelnikov (RU 2089499). It is respectfully submitted that the rejection is not well taken.

Rutherford et al. discloses a surface-coated nanoporous silica dielectric film in which a polymeric layer is deposited onto a silica dielectric film on a substrate. Rutherford, et al then may apply a *monomeric* surface modification agent such as those enumerated on column 8, lines 15, et seq. However, none of the claims indicate that their surface modification agent is an oligomer or polymer *reactive with silanol groups* on a silica film.

The Rutherford, et al claims are of a materially different scope because their coating materials are different than the surface modification agents within the scope of the claimed invention and do not form coatings on silica dielectric films as the claimed films in which surface modification agents which are *oligomer or polymer reactive with silanol groups on said silica film* and form a hydrophobic coating thereon. The arguments over Grainger and Kotelnikov are repeated from above.

None of the cited references, taken alone or in combination, teaches or suggests the invention claimed by Applicants. For all the above reasons, claims 2-29 and 31-34 are urged to be patentable over the cited references, and the rejections under 35 U.S.C.103 should be overruled.

Respectfully submitted,

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Date: April 29, 2004

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail, postage pre-paid in an envelope addressed to Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450, on April 29, 2004.

Richard S. Roberts